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Investigating the preferences of older people for telehealth as a new model of health care service delivery: A Discrete Choice Experiment

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ABSTRACT

Background

Telehealth approaches to healthcare delivery can potentially improve quality of care and clinical outcomes, reduce mortality and hospital utilisation and complement conventional treatment programs. However, substantial research into the potential for integrating telehealth within healthcare in Australia, particularly in the provision of services relevant to older people including palliative care, aged care and rehabilitation, is lacking. Furthermore, to date, no discrete choice experiment (DCE) studies internationally have sought the views and preferences of older people about the basic features that should make up a telehealth approach to these services.

Methods

Using a DCE, we investigated the relative importance of six salient features of telehealth (what aspects of care are to be pursued during telehealth sessions, distance to the nearest hospital or clinic, clinicians' attitude to telehealth, patients' experience of using technology, what types of assessments should be conducted face-to-face versus via telehealth sessions and the costs associated with receiving telehealth). Data were obtained from an online panel of older people aged 65 years and above drawn from the Australian general population.

Results

The mean age for 330 study participants was 69 years. In general, individuals expressed strong preferences for telehealth services that offered all aspects of care, were relatively inexpensive, and targeted specifically at individuals living in remote regions without easy access to a hospital or clinic. Participants also preferred telehealth services to be offered to individuals with some prior experience of using technology, provided by clinicians who were positive about telehealth but wanted all or some pre-telehealth health assessments to take place in a hospital or clinic. Preferences only differed by gender. Additionally, respondents did not feel that telehealth led to loss of privacy and confidentiality.

Conclusions

Our findings indicate a preference amongst respondents for face-to-face pre-telehealth health assessments and, thereafter, a comprehensive telehealth model (in terms of services offered)

targeted at those with some technological know-how as a substitute for attendance at hospitals and clinics especially where these health facilities were far away from older people's homes. The findings may be usefully incorporated into the design of future telehealth models of service delivery for older people.

Key words: telehealth, rehabilitation, palliative care, aged care, discrete choice experiment

Background

Telehealth involves the use of 'information and communications technologies to deliver healthcare and transmit health information over both long and short distances' [1]. There are many ways telehealth technology can be used [2]. For example, and as demonstrated by our group in the Flinders Telehealth in the Home (FTH) trial [3, 4], a patient may have a consultation with their healthcare provider via video conference from their home, instead of travelling to an appointment. Other examples include the use of health information technology for management of chronic disease and medication (e.g. electronic medical records) [5], use of individual mobile devices for monitoring and transmitting data on physiological indicators following a fall or injury (e.g. smart phones and tablets) [6] and the use of environmentally based devices for detecting falls in community dwelling older people (e.g. sensors) [7].

Across different health systems, telehealth approaches can potentially improve quality of care and augment conventional treatment programs. For instance, a recent systematic review assessing the effectiveness, acceptability and costs of interactive telehealth (telemedicine) in differentiated clinical conditions reported evidence of an association between telehealth and improved quality of life for heart failure patients [8]. The review also showed a positive relationship between telehealth and lower glycated haemoglobin and blood pressure in people with diabetes [8]. Benefits of telehealth have also been observed in terms of improved clinical outcomes [9-11], reduced mortality [12],decreased hospital utilisation [13, 14], enhanced patient preferences [15], increased service and patient time [16] and reduced use of personal assistance services [17]. Evidence from a large recent randomised controlled trial (the UK Whole System Demonstrator Trial) indicated that, despite the absence of evidence of cost-effectiveness [18], telehealth is associated with lower mortality rates and emergency visits [9].

As people age they are more likely to need health care and the majority of individuals requiring specialist rehabilitation and palliative services are older people aged 65 years and above. The Productivity Commission Inquiry Report in 2011 '*Caring for Older Australians*' [19] states that 'fundamental reform is required' to respond to current and future challenges that exist in Australia's aged care system. These challenges include a significant increase in the number of older people, an increasing incidence of age-related disability and disease and rising expectations about the type and flexibility of care that is received [20]. The introduction of

a telehealth model of care potentially allows more people from a wider area to access specialist health care services (e.g. in rehabilitation, aged care and palliative care) by negating or minimising the need for travel to service providers [9, 21]. Distance from metropolitan services can present a significant barrier to accessing subacute healthcare services (rehabilitation, geriatrics and palliative care) [22]. Regardless of geography, travel to and attendance at health appointments can be also stressful and physically taxing, particularly for older people and people with dementia or significant disabilities [23], as well as their carers.

Research from our group [4, 16, 24] and elsewhere [17, 24-26], has also shown that telehealth services can replace some in-person visits while enhancing patient outcomes. Additionally, there is a growing evidence base of the usefulness of telehealth for providing health and allied services particularly for older people with recent systematic reviews reporting benefits in various contexts including aged care (improved quality of life) [27], geriatrics and gerontology (improved health outcomes and patient satisfaction) [28], rehabilitation (improved functional improvement and reduced rick of hospital admission) [29] and palliative care (reduced need for hospital admissions and cost savings) [29]. Several previous studies have focused upon older people's perceptions and acceptance of telehealth [30-34]. However, less is known about the relative importance of different attributes related to telehealth service provision such as geographic proximity to health services or costs to individual consumers.

This paper reports on the first study internationally to employ discrete choice experiment (DCE) methodology [35] to assess older people's preferences in relation to the salient features of telehealth care. We also sought to identify the extent to which individual characteristics such as living arrangements and presence or absence of a long-term disability may or may not influence individuals' preferences for attributes of telehealth service delivery.

Methods

Discrete choice experiment methodology

Discrete Choice Experiment (DCE) is a stated preference quantitative technique originating in mathematical psychology which is designed to establish the relative importance and impact of individual attributes, or characteristics, upon the overall utility of a good or service[36]. In a DCE, respondents are presented with a sequence of hypothetical scenarios (choice sets) made up of two or

more competing alternatives that vary according to attributes that define them[35]. For each choice set, respondents choose their preferred scenario that, based on the Lancasterian framework[37], represents the alternative with the highest utility [35]. From these responses, the probability of choosing an alternative as a function of the attributes and other factors can then calculated allowing this method to go beyond the traditional qualitative assessments and provide quantifiable data depicting the strength of respondents' preferences for particular attributes [35]. Unlike traditional ranking and rating exercises, DCE also goes further to provide quantitative information on marginal rates of substitution across attributes, trade-offs between attributes and predicted probabilities of uptake or demand for particular alternatives [35]. An added advantage of DCE generated preferences for alternative scenarios is the ability to apply them within the framework of economic evaluation to inform health care management decision-making[38].

Development of attributes and the DCE survey

In a prior qualitative study, a series of qualitative interviews with 17 participants (older patients aged between 60 and 92 years, spouses and carers of patients receiving rehabilitation treatment in Metropolitan Adelaide [39]) and focus groups with 44 healthcare and allied services professionals were conducted between December 2012 and November 2013. Of the 44 professionals, 36 were from the rehabilitation and palliative care sector (29 Metropolitan and 7 country) while 8 were from the residential aged care sector (all country). Using thematic and constant comparative analysis [40-42], consistent with good practice guidelines for the development of attributes and levels for a DCE study [43, 44], salient service characteristics important to participants were determined and formulated into attributes and attribute-levels for presentation within a DCE. Initially eight broad potentially important telehealth attributes were identified and these were reduced, through discussions with the research team, to six salient service features or characteristics each with three levels defining increasing gradations of telehealth-based health services as shown in Table 1. Some of these final attributes align with the most important constructs (in terms of their strength of predicting behavioural intention) within the extended united theory of acceptance and use of technology (UTAUT2) designed to aid understanding of acceptance and use of technology amongst consumers [45]. First, the telehealth model was a priori assumed to be effective and lead to benefits and therefore had a high degree of 'performance expectancy' defined as the extent to which using

technology will lead to benefits to consumers[45]. Specific UTAUT2 constructs[45] reflected within the DCE attributes (with the related attributes in parentheses) were 'social influence' (clinicians' attitude to telehealth), 'habit' (technology-experience levels of patients targeted by telehealth) and 'price value' (cost of telehealth to you).

A DCE survey was developed for our study population and following ethical approval for the study granted by the Flinders University Social and Behavioural Research Ethics Committee, the survey was piloted with 10 older people. It was subsequently revised to improve phraseology and question layout resulting in a final version of the survey which included a preamble that (i) defined the terms 'telehealth services', 'rehabilitation', 'aged care' and 'palliative care' (ii) provided examples of telehealth services available in Australia and (iii) presented specific examples of telehealth services specific to rehabilitation, palliative care, and aged care. The rest of the survey comprised four sections. Section A contained nine attitudinal statements relating to the administration and delivery of telehealth services within rehabilitation, palliative care and aged care presented using a Likert-scale format. Section B consisted of the DCE whereby individuals were presented with a series of choice questions in which respondents were asked to indicate which of two hypothetical telehealth services (comprised of differing levels of the salient attributes) they would prefer, again within rehabilitation, palliative care and aged care. A forced-choice design was used in order to arrive at a more efficient design [35]. Sections A and B were considered as complements of each other with the former used a 'warm-up' exercise for the latter. Section C contained questions about participants' demographic characteristics and Section D was made up of questions on quality of life (QoL). QoL measures included the EuroQoL EQ-5D 5 level (EQ-5D 5L) which is a generic-preference-based measure of health-related QoL and the Older People's Quality of Life brief questionnaire (OPQoL-brief) which is a non-preference-based measure of health-related and broader QoL. For both measures, a higher score is associated with a higher QoL.

A D-efficient D_z-error measure DCE design (with zero priors) was created in Ngene software [46]. To minimise participant burden, three blocks of six choice sets (each with two alternatives) were developed for administration to DCE participants. An example DCE choice set

presented to participants is shown in Table 2. We used a 'main effects only' design with interactions tested within the analysis.

DCE participants and administration of surveys

Older people aged 65 or over were recruited from the Australian general population by "PureProfile", an Australian online panel company that specialises in conducting online polls and surveys with members of the general community. A wide selection of participants were drawn from PureProfile's panel of online account holders and chosen to enable maximum variation with regards to a number of important characteristics including age, gender, ethnicity, living arrangements, income levels, education level and employment status from both metropolitan and country areas in Australia. The inclusion of country participants provided valuable information about the preferences of people living in country areas for whom telehealth has the potential to improve access to specialist health services. The questionnaires were administered via an online portal in July 2014.

Statistical and econometric approaches

Established scoring algorithms provided by the respective instrument developers were used to score responses to the EQ-5D 5L and OPQoL-Brief. The EQ-5D 5L was scored using Australian value sets developed by Norman et al [47]. We generated descriptive statistics and conducted statistical tests of differences for responses to statements relating to the administration and delivery of telehealth services and to questions on participants' demographic characteristics and QoL.

Our econometric approach was based on a standard random utility framework [48] which assumes that participants choose the alternative that maximises their utility. The respondents were first treated as different subgroups (female or male, whether one lived alone or not, whether DCE participants had gone beyond high school in their education or not, whether or not participants had used the internet for health-related purposes in the three months prior to the study and whether or not they had a long-term disability). The subgroups were chosen because they have been shown to impact on technology use in the literature[49-51]. After testing for poolability using the Swait-Louviere log-likelihood ratio (SL) test of equal model parameters [52], eligible subgroups were then analysed as a pooled sample. Failure to reject

the null hypothesis of equal model parameters implies that the preferences of groups tested do not differ in terms of preferences and scale [52]. The utility (*U*) of alternative *j* for individual *n* in choice set *k* was specified as:

$$U_{njk} = \beta_n X_{jk} + \varepsilon_{njk}$$

where *X* was a vector of observed attributes, β was the corresponding coefficient (parameter) and ε_{njk} was an error term which was assumed to be an independent and identically distributed (IID) extreme value.

In the first instance, a traditional conditional logit (clogit) [53] was fitted to the data. Three types of regression models were then used to account for heterogeneity. Firstly the heteroscedastic conditional logit (clogit-het) which tests for observed scale heterogeneity only [53]. Secondly, the mixed logit (MXL) which accounts for unobserved taste or preference heterogeneity only [54], and finally, the generalised multinomial logit (G-MNL) which takes account of both unobserved preference and scale heterogeneity simultaneously [55-57]. A number of studies have shown that incorrectly restricting preferences to be homogeneous may lead to biased parameter estimates for individuals [55, 58, 59] with policy implications in terms of the optimal implementation of results from a DCE [55, 60]. The statistical fit of the clogit, clogit-het, MXL and the G-MNL was assessed using the Akaike information criterion (AIC) statistic with lower values implying a superior fit [61]. The aim was to focus on results from the model with the most superior fit whilst accounting for any heterogeneity present in the data. The predicted probability of each combination of attribute levels being the preferred package was simulated using estimates from the model coefficients [57, 62]. We also estimated the proportion of the participant population for whom particular telehealth attributes had a positive or negative effect on their choice of telehealth package.

In all models, observed heterogeneity was explored via subgroup analysis based on individual characteristics. All models were first specified using main effects only and thereafter using both main and interaction effects. The key interactions considered were between telehealth attributes and the respondent's location when completing the DCE in order to control for any potential effect of location on participant preferences. The location dummy was equal to 1 if

one was in a metropolitan area and equal to 0 if not. We also tested the appropriateness of including the cost attribute as a linear and continuous effect within the regression models by adding and then examining the statistical significance of the quadratic term of this attribute. An insignificant quadratic term would suggest that the linear assumption was appropriate [63].

Internal consistency was measured using a test of non-satiation[64] based on a choice of restaurant (A or B) presented as a practice question. All levels of attributes for restaurant A (in terms of distance from respondent's home, menu, size of meal and cost) were better than those for restaurant B. Individuals were only deemed rational if they chose restaurant A. This test was not based on telehealth scenarios because the attributes and levels we included within the telehealth scenarios did not easily lead to a test of dominance of one scenario over another. There was no missing data to account for in the analysis. A significance level threshold of 5% (0.05) was assumed as the criterion for determining statistical significance in all analyses [65]. All analyses were conducted in Stata version 13.1 [66].

Results

Demographic, internet-related health care use and quality of life details

The results relating to the demographic characteristics, health and QoL as well as selected information on health care service provision are presented in Table 3. A total of 330 respondents provided data for this study. Slightly over half of the study sample was female (171, 52%) or lived in a metropolitan area (182, 55%). The majority did not have a long-term disability (198, 60%) and also reported not having used the internet in the three months prior to the study for health-related purposes (192, 58%). The mean and median ages of our sample were both 69 years. The mean EQ-5D 5L score for the entire sample was 0.73 but higher for certain subgroups (i.e. 0.76 for individuals who had not used the internet in the three months prior to the study for health-related purposes compared to 0.69 for those that had and 0.86 for older people without a long-term disability compared to 0.64 for those with a long-term disability). The mean and median OPQoL-brief scores for the entire sample were 55.85 and 57, respectively. Similarly, the OPQoL-brief scores were higher for the two subgroups that also recorded higher EQ-5D 5L scores.

The majority of older people who participated in the DCE survey indicated that they lived with their spouses (66%) while 27% lived alone. This pattern was similar across all three subgroups previously described. A higher proportion of older people were educated beyond high school (63%) with the pattern again replicated across the subgroups and the majority in the entire sample and across all subgroups (96-99%) reported never having used telehealth before. Finally, respondents were asked to indicate approximately how many times they had visited a specialist for the treatment of a health condition in the three months prior to the study. The mean and median numbers of times were 1.5 and 1, respectively.

Responses to attitudinal questions

Supplementary material Table 1 presents information on participants' levels of agreement with nine statements relating to the administration and delivery of telehealth services. Responses were analysed according to all pairs of subgroups outlined in the methods section, in addition to respondents' location, and show that the majority of participants (range 71-94%) either agreed or strongly agreed with the first six statements. Further, there was more agreement than disagreement (41% versus 18%) with the statement that "Health examinations need to occur face to face in a clinic and not via telehealth". Lastly, there was more disagreement than agreement with the statements that "Telehealth leads to loss of privacy and confidentiality" and that "Telehealth should only be offered to people living in the country or in a rural area" (51% versus 13% and 41% versus 28%, respectively).

When analysed according to subgroups, the only statistically significant differences in preferences expressed were in terms of agreement with the following statements: 'a good understanding between patients and telehealth clinicians is important' (higher amongst females and those without a long-term disability); 'health examinations need to occur face to face in a clinic not via telehealth' (higher amongst individuals with prior experience of using telehealth or health-related internet services) and 'an initial face to face health clinic consultation needs to occur prior to telehealth' (higher amongst individuals with prior experience of using telehealth). Other significant differences in agreement were seen for 'Telehealth leads to loss of privacy and confidentiality' (lower for individuals with prior experience of using telehealth); 'When services are hard to access, Telehealth is a good

alternative' (higher amongst those who reported health-related internet use in the three months prior to the study) and 'Telehealth monitoring by clinicians will improve patients motivation' (higher amongst those who reported health-related internet use in the three months prior to the study).

DCE results – test of consistency and comparisons between regression models and subgroups

All respondents in this study chose the most dominant option in the test of consistency and therefore passed the test. The results of the clogit-het presented in Supplementary material Table 2 do not show any evidence of scale heterogeneity. The results of the G-NML (available upon request from the authors) confirmed this finding. However the results from the MXL confirmed the presence of some preference heterogeneity. In addition, the statistical fit (assessed by the AIC) for the MXL models was better than that for all other models suggesting that the former was an improvement over other models. Therefore, only DCE results from the MXL are presented below.

The main DCE results are shown in Table 4. The $\chi 2$ statistics from the Swait-Louviere likelihood ratio tests for equality of model parameters for four of the five pairs of subgroups considered in the study (defined by living arrangements, educational level, prior usage of the internet for health-related purposes and presence/absence of long-term disability) were all lower than the $\chi 2$ critical value of 26.296 (based on 5% level of significance and 16 degrees of freedom). This therefore meant that analysing the data relating to these four subgroups as a pooled sample was appropriate. On the other hand, $\chi 2$ statistics for the gender was higher than the $\chi 2$ critical value suggesting significant differences between preferences for males and those for females. The quadratic terms of the cost attribute in all models were statistically insignificant suggesting that it was appropriate to specify this attribute as a linear and continuous variable.

DCE results - attributes important in choice of telehealth packages

These are also shown in Table 4. In the simulation-based technique, 500 Halton draws were run. In choosing a telehealth package (for the pooled sample), participants expressed a strong preference for telehealth services targeted at individuals for whom the nearest hospital

or clinic that could serve as an alternative to telehealth services was between 15 and 100km away from their homes and for services focussed on individuals with some experience of using technology. In addition, there was a strong preference for telehealth services associated with lower costs as well as telehealth services where a clinician pursued all or most aspects of care during a telehealth session, where all or some of the health assessments took place in a clinic prior to a telehealth session and where clinicians were very or moderately positive about the telehealth service. These results did not differ according to respondents' location (metropolitan or rural, Supplementary material Table 3).

Sub-group analysis revealed some differences in preferences according to gender. Compared to females, males were relatively more concerned that telehealth services should be made available to those living at a greater geographical distance from the nearest hospital or health care facility, that all aspects of care should be covered within telehealth sessions, and that patients had prior experience with technology and the cost of telehealth. Females were more concerned about having some pre-telehealth assessments take place in a clinic and clinicians' attitude towards telehealth. As also shown in Table 4, only a few standard deviations for the subgroups and the sample as a whole were statistically significantly different from zero, which suggests that despite the differences in sub-group preferences identified above, there was an absence of substantial preference heterogeneity in the data in general [57]. Assuming a normal distribution for random parameters in the MXL model results, it was also possible to estimate the proportion of the participant population for whom particular telehealth attributes had a positive or negative effect on their choice of telehealth package. All attributes, with the exception of the cost attribute, were found to have a positive effect on choice.

Table 5 presents the predicted probabilities, together with 95% confidence intervals, associated with choosing a particular telehealth package for the ten most preferred packages. The 95% confidence intervals of the preference scores and probabilities overlap suggesting that there were no statistically significant differences between preferences for the top 10 preferred telehealth packages. This implies that these packages were all highly valued by respondents. The most preferred package was one: that targeted individuals for whom the nearest hospital or clinic that could serve as an alternative to telehealth services was between

15 and 100km away from their homes, where clinicians pursued all aspects of care during a telehealth session, targeted at individuals with some experience of using technology, where some of the health assessments took place in a clinic prior to a telehealth session, has a low associated cost and where clinicians were moderately positive about the telehealth service. In general, respondents were willing to make trade-offs between all attributes except those related to distance to the nearest clinic or hospital and cost of telehealth.

Discussion

To our knowledge, this is the first study that has sought to utilise DCE methodology to assess the attitudes and preferences of older people for a telehealth approach to a number of health-related services. Our findings indicate that all six attributes identified during the first phase of our project and then tested on Australian older people were significant in determining the choice of a telehealth package. However, having clinicians who were very or moderately positive about telehealth services as well as having a comprehensive list of services provided by these clinicians were the strongest determinants of this choice while the cost of the service (preference being for a cheaper one) was the weakest. When contrasted against telehealth services currently available in Australia where only select Medicare-funded telehealth services are available to patients outside major cities (e.g. specialist video consultations) [67], our results from the DCE (table 4) show that older people want all health services suitable for delivery via telehealth to be provided. However, it was also clear that respondents feel that telehealth should not completely replace necessary in-person contact with clinicians preferring that all or some of the initial assessments take place in a clinic prior to a telehealth session. These findings confirm other research suggesting that telehealth should be seen as a supplement to, rather than a substitute for, traditional care; providing additional services that otherwise would not or could not be provided [68-70]. These results are highly relevant for policy makers as they present empirical evidence to indicate what basic features should make up a telehealth approach to rehabilitation, aged care and palliative care services from the perspectives of older people. These findings may also be incorporated into the framework of economic evaluation, by combining the DCE results with information relating to the costs associated with the provision of preferred telehealth service configurations, in order to provide an assessment of the cost effectiveness of models of telehealth care [38]. Such cost information would be particularly useful given that appropriate valuation of health and non-health

outcomes has been identified as one of the challenges to the economic evaluation of telehealth [71].

The mean and median ages for participants in this DCE were both 69 years representative of the eligibility criteria for the study i.e. survey targeted at those aged 65 years and over. However, the proportion of those aged 65-69 years (85%) was much higher than that reported for the general population in the Australian 2011 census (31%) [72]. This is not surprising as our target sample of people who use the internet is most likely to be that of the younger old. Compared to the people aged 65 years and over in the general population[72], our sample had more individuals who had completed additional training (38% versus 14%) or university education (25% versus 18%). This again is an artefact of the sample studied i.e. those who use the internet and therefore more likely to have higher levels of education as they are required to have some level of technological-know how. No Australian population norms for the EQ5D 5L are as yet available. When compared against the EQ-5D 3 level scores found in the general Australian for older people aged 65-74 years (mean score of 0.82) and for those aged 75+ (mean score of 0.80) [73] however, older people in our sample had slightly lower QoL as measured by the EQ-5D 5L (mean score of 0.73). This may be because the EQ-5D 5L is more sensitive and has smaller ceiling effects [74] which therefore allows for more intermediate QoL scores to be registered. Our sample was however representative of older Australians in other characteristics reported in the 2011 census [72] and in other Australian research[75, 76] . The majority of people in our sample (52%) were female which is fairly representative of the 54% figure reported in the census. Similarly, the proportions of individuals in our sample living alone (27%) or with their spouses (66%) were similar to those in the general population (25% and 56%, respectively). Further, 60% of our sample reported having a long-term disability which falls within the 10% - 68% range reported in the census. Though the proportion of individuals in our sample who lived in a metro area (55%) was lower than that in the general population (65%), census statistics [72] suggest that the proportion of just the younger old (which made up the bulk of our sample) is likely to be much lower than 65% which may explain our figures. Nationally representative OPQoL-Brief mean scores are also not available in Australia but the mean score for our sample (55.85) was similar to those found in a recent study that explored the QoL of older people receiving rehabilitation services (N=21) in South Australia using the same instrument (mean score 54.6) [75]. The mean score for those who

reported having a long-term disability (and may therefore have probably needed health and other interventions) was 53.78 which is much more comparable to the score from the South Australian study [75]. It is notable that 138 older people (48%) reported having used the internet in the three months prior to the study for health-related purpose. While the '2012–13 Multipurpose Household Survey' for persons aged 65 years or over [76] did not specifically ask if the type of online activities undertaken at home by older persons were health-related and what percentage of users accessed such information, 50% of these activities involved accessing government services which may have included those that were health-related.

The vast majority of older people (98%) had not used telehealth services before and this is reflective of the relative infancy of the telehealth approach as it applies to health care for older people and the knowledge gaps in terms of determining older people's technology needs[77]. It was also evident that older people want to engage with telehealth service clinicians who are themselves positive about the service. This is line with research that shows that champions of telehealth play an important role in its development and acceptance [78-81]. The responses to the attitudinal statements also showed that older people had specific views about how telehealth should be administered, which also filtered through into their responses to the DCE questions. In particular, they felt that telehealth services should be targeted at people for whom hospital services are hard to access but mainly due to distance to hospitals or clinics and not necessarily due to living in the country or rural areas. Defining need on the basis of lack of proximity to health institutions rather than on rurality per se aligns itself well with the core objective of many telehealth services: 'the delivery of health care services where distance is a critical factor' [21]. Further, DCE participants underlined the need for a good rapport to exist between clinicians delivering these services and patients. The importance of 'user friendliness of information and communication technology services' used to support older people has also been highlighted elsewhere [82, 83]. This outlook may also explain why the majority in our sample felt that telehealth would lead to an improvement in "patients' motivation and willingness to comply with healthcare recommendations" without the risk of loss of privacy and confidentiality. This is notable as older Australians have cited lack of confidentiality as a concern when using telehealth services in another study [83]. While there was a good proportion that felt that all health examinations need to occur face to face in a clinic and not via telehealth, the majority of participants were of the view that at least the initial

health consultation prior to telehealth sessions needs to occur in a clinic in line with other research [68-70].

The results from the DCE highlighted that in order of the strength of preference, study participants favoured telehealth services: (i) where clinicians were very positive or moderately positive about the telehealth service (ii) where a clinician pursued all or most aspects of care during a telehealth session (iii) where all or some of the health assessments took place in a clinic prior to a telehealth session (iv) targeted at those for whom the nearest hospital or clinic that could serve as an alternative to telehealth services was between 15 and 100km away from their home (v) targeted at individuals with some experience of using technology and (vi) that had a low associated cost. The results from the mixed logit regression model also show that statistically significant telehealth attributes had a positive effect on the decision to choose telehealth packages for at least 57% of the respondents (except cost which had a negative effect on 81% of the respondents). The latter result is not surprisingly given that most health services in Australia are provided through Medicare with a zero or reduced cost to patients at the point of use as has been seen in other countries with similar health funding systems [84].

This study had some limitations. First, some studies have shown that strategies used to choose among alternatives vary with age[85, 86] leading to inconsistent choices being made by older respondents. Even though all respondents in our study passed the test of consistency (suggesting that it was plausible to assume that preferences expressed by these respondents were rational), this test was not based on telehealth scenarios which would have been more consistent with the rest of the DCE. However, the results of this test were still in line with our other research that shows that it is possible to get consistent responses from older respondents[87, 88] and that cognitive decline due to old age does not have a significant effect on the consistency of responses to a DCE survey[89]. Second, participants were essentially a self-selected group who were able to use the Internet and also part of PureProfile's online database. They may therefore not be entirely representative of older people in the Australian general population especially as the proportion of Australian internet users aged 65 years and over is about 46% [76]. However we did achieve wide representation across Australia and the study participants were reflective of a broad range of socio-demographic characteristics. Third, in developing the DCE attributes, the older people interviewed were all rehabilitation

patients and their views may not be completely generalizable to those of older people in the Australian general population. We however also conducted qualitative interviews with carers and focus groups with healthcare and allied professionals which, when combined with the views of experts involved with our study, helped to develop more representative DCE attributes.

Conclusions

The findings from this study are significant for policy makers as it represents the first empirical evidence about what basic features, from older people's perspectives, should make up a telehealth approach to a range of services, including palliative, aged and rehabilitation care services as revealed in the responses to the DCE forced-choice questions. Telehealth programmes in Australia and internationally have been shown to be associated with improvements including lower costs and reduced inconvenience while accessing specialist health services; better clinical outcomes; reduced mortality and hospital utilisation; improved access to services and improved quality of clinical services [9-14, 90]. In addition to views including that telehealth does not lead to loss of privacy and confidentiality or that telehealth should not only be offered to people living in the country or in a rural area revealed through responses to the attitudinal statements (Likert scale), our findings from the DCE revealed respondents' choice of telehealth attributes in order of strength of preference as well as the predicted probabilities associated with choosing particular telehealth packages. These findings indicate a preference amongst respondents for a comprehensive telehealth model (in terms of services offered) targeted at those with some technological know-how as a substitute for attendance at hospitals and clinics especially where these health facilities were far away from older people's homes. This is line with the federal government's policy for a telehealth model with wide coverage. The potential for the future provision of telehealth services at costs lower than those incurred when older people physically attend health institutions will be a key attraction for health systems internationally as will having clinicians who are champions of the telehealth model. The findings from this DCE study may be usefully incorporated into the design of future telehealth models of service delivery for older people. More generally, DCEs offer a promising approach for the systematic incorporation of older people's preferences into the future design and delivery of service innovations in health and aged care.

Declaration of conflicting interests

All authors declare that they have no conflict of interest.

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Guarantor and statement of contributorship

BK & JR analysed the data, interpreted the results, and were also involved in the design of the study and ethics submission. WS, MK and MC were involved in the design of the study, ethics submission and also undertook the focus groups and qualitative analysis which informed the choice of discrete choice experiment (DCE) attributes. VW, CC, AT and MK contributed to the survey design. JT contributed to discussions about focus group questions for DCE attributes and to the DCE survey. All authors contributed to the interpretation of results and revision of the manuscript. All authors have read and approved the final manuscript. BK is the guarantor of the manuscript.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This study was approved by the Flinders University Social and Behavioural Research Ethics Committee and all subjects gave written informed consent

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Table 1: Attributes and Attribute Levels

Attribute	Description	Attribute levels	Variable name used in models
Aspects of care in telehealth sessions	What sort of aspects of care are clinicians able to pursue during telehealth sessions?	• All aspects of care • Most aspects of care • A few aspects of care	• All_CareAspects • Most_CareAspects • Few_CareAspects
Distance to nearest hospital or clinic[a]	How far from your home is the nearest hospital or clinic which could be used as an alternative to telehealth sessions?	• Less than 15km away • Between 15 and 100km • More than 100km	• LessThan_15km • Bet_15to100km • MoreThan_100km
Clinicians' attitude to telehealth	What is the clinicians' attitude to using telehealth?	• Very positive • Moderately positive • Uncertain	• Very_Positive • Moderately_Positive • Uncertain
Technology-experience levels of patients targeted by telehealth	What sort of experience of using technology should individuals targeted by telehealth services have?	• A lot of experience • Some experience • No experience	• Lots_Experience • Some_Experience • No_Experience
Assessments related to telehealth sessions	What sort of assessments need to be done face to face in the clinic and not via telehealth?	• All assessments • Some assessments • No assessments	• All_Assessments • Some_Assessements • No_Assessments
Cost of telehealth to you[b]	How much you need to pay towards the cost of providing telehealth services.	• $0 • $40 • $80	Cost_telehealth (continuous variable)

Note: Effects coding utilised for all variables except for 'Cost_telehealth'

[a] Whereas proximity of patient residence to health services has been measured in terms of both travel time and distance in the literature (e.g. Bliss et al[91]), we chose the latter in this study as the former is more variable e.g. it may depend on the mode of transport used. Further, Australian telehealth policy focuses on distance (geographical eligibility) rather than time and specifies that for a location to qualify for telehealth services generally, "…there must be 15 km by road between a patient and a specialist, consultant physician, or consultant psychiatrist"[92]

[b]The levels for this attribute (i.e. $0, $40 and $80) represent, respectively, the lowest telehealth cost possible (with full Medicare concessions), the average MBS fee for telehealth services related to palliative care, aged care and rehabilitation[93] and the maximum average cost per telehealth consultation charged within the Flinders Telehealth in the Home (FTH) trial[3, 4] which funded this study.

Table 2: Example telehealth choice set for older people

Attribute	Package 1	Package 2
1. How much are clinicians able to do in telehealth sessions?	**Most** aspects of care.	**A few** aspects of care.
2. Distance from nearest hospital or clinic for patients targeted by telehealth	**Less than 15km** away from your home.	**Between 15 and 100km** away from your home.
3. Clinicians' attitude to telehealth	**Moderately** positive.	**Very** positive.
4. Technology-experience levels of patients targeted by telehealth	Patients with **some** experience of using technology.	Patients with **no** experience of using technology.
5. Assessments related to telehealth sessions	**No** assessments occur face to face.	**Some** assessments occur face to face.
6. Costs of telehealth to you	**$0** per telehealth consultation.	**$40** per telehealth consultation.

Table 3: Demographic, internet-related health care use and quality of life details

	Gender		Did participant use the internet for health-related issues in previous 3 months?		Have a long-term disability?		Entire sample
	Female	Males	Yes	No	Yes	No	**N = 330**
	N=171	N=159	N = 138	N = 192	N = 198	N = 132	
Mean (Median) age in years~	69 (69)	70 (69)	70 (69)	69 (69)	70 (69)	70 (69)	69 (69)
Mean (Median) QoL (EQ-5D score)	0.72 (0.80)	0.72 (0.81)	0.68 (0.77)	0.75 (0.85)	0.61 (0.70)	0.88 (0.92)	0.72 (0.81)
Mean (Median) QoL (OPQoL score)	56.36 (57.00)	55.30 (56.00)	54.67 (55.00)	56.69 (58.00)	53.78 (55.00)	58.95 (60.00)	55.85 (57.00)
Age groups in years (%)							
65-69	86	84	85	85	84	86	85
70-74	14	14	14	14	15	14	14
75+	0	1	1	1	1	0	1
Living arrangements (%)							
Living on their own	35	18	24	59	32	20	27
Living with your spouse	56	77	69	64	62	73	66

	Gender		Did participant use the internet for health-related issues in previous 3 months?		Have a long-term disability?		Entire sample
	Female	Males	Yes	No	Yes	No	**N = 330**
	N=171	N=159	N = 138	N = 192	N = 198	N = 132	
Living with other family	6	2	4	4	2	6	4
Living with others (not family)	3	3	3	3	4	2	3
Highest qualifications (%)							
Primary School	4	1	2	2	2	2	2
Some secondary School	15	15	11	18	15	16	15
Completed Secondary School	23	17	21	19	18	23	20
Some additional training	36	40	36	39	39	36	38
Undergraduate degree	18	17	18	16	15	20	17
Postgraduate degree	5	10	10	6	11	3	8
Ever used telehealth before? (%)							
Yes	4	1	3	2	2	3	2

	Gender		Did participant use the internet for health-related issues in previous 3 months?		Have a long-term disability?		Entire sample
	Female	Males	Yes	No	Yes	No	**N = 330**
	N=171	N=159	N = 138	N = 192	N = 198	N = 132	
No	96	99	97	98	98	97	98
Location							
Metro	56	55	54	56	51	61	55
Country	44	45	46	44	49	39	45
Mean (Median) number of times in previous 3 months respondent has visited a specialist's room.	1.4 (1.0)	1.6 (1.0)	2.0 (1.0)	1.2 (0)	2.0 (1.0)	1.0 (0)	1.5 (1.0)

Table 4: Mixed logit regression estimates[a]

Attribute levels	Gender		Living arrangements		Education level		Did participant use the internet for health-related issues in previous 3 months?		Did participant have a long-term disability?		TOTAL sample	TOTAL sample (% positive)[b]
	Female	Male	Living alone	Living with others	Up to High School	Post-High School	Yes	No	Yes	No		
Mean												
Bet_15to100km	0.709 (0.304)*	0.778 (0.289)**	2.149 (1.216)	0.617 (0.194)**	1.293 (0.721)	0.634 (0.209)	0.824 (0.000)**	0.513 (0.174)**	0.507 (0.208)*	0.747 (0.272)**	0.614 (0.154)**	99%
MoreThan_100km	-0.121 (0.294)	0.392 (0.296)	-1.660 (1.118)	0.213 (0.190)	-0.423 (0.506)	0.348 (0.221)	0.432 (0.000)	-0.101 (0.185)	0.154 (0.237)	0.129 (0.264)	0.126 (0.160)	53%
Most_CareAspects	0.944 (0.366)	0.589 (0.307)	2.340 (1.116)*	0.503 (0.203)*	1.482 (0.725)*	0.386 (0.213)	0.705 (0.000)*	0.356 (0.187)	0.467 (0.224)*	0.608 (0.298)*	0.491 (0.164)**	81%
All_CareAspects	1.102 (0.350)**	1.292 (0.346)**	2.026 (1.116)	1.000 (0.225)**	1.232 (0.737)	1.194 (0.286)	1.548 (0.000)**	0.635 (0.197)**	0.991 (0.237)**	0.847 (0.284)**	0.898 (0.172)**	82%
Some_Experience	0.499 (0.270)	0.627 (0.256)*	-1.095 (1.503)	0.437 (0.175)*	1.411 (0.754)	0.251 (0.182)	0.698 (0.000)	0.195 (0.165)	0.400 (0.201)*	0.420 (0.233)	0.374 (0.143)**	99%

Attribute levels	**Gender**		**Living arrangements**		**Education level**		**Did participant use the internet for health-related issues in previous 3 months?**		**Did participant have a long-term disability?**		**TOTAL sample**	**TOTAL sample (% positive)[b]**
	Female	Male	Living alone	Living with others	Up to High School	Post-High School	Yes	No	Yes	No		
Lots_Experience	-0.141 (0.319)	0.499 (0.307)	0.232 (1.260)	0.168 (0.188)	0.183 (0.490)	0.139 (0.217)	0.081 (0.000)	0.268 (0.185)	0.270 (0.219)	0.000 (0.292)	0.173 (0.163)	57%
Some_Assessments	1.257 (0.338)**	0.582 (0.232)*	5.551 (2.482)*	0.752 (0.166)**	0.860 (0.471)	0.861 (0.197)	1.028 (0.000)**	0.578 (0.156)**	0.805 (0.185)**	0.494 (0.216)*	0.757 (0.148)**	95%
All_Assessments	0.795 (0.312)*	0.380 (0.267)	0.114 (0.835)	0.539 (0.187)**	0.656 (0.481)	0.502 (0.221)	0.655 (0.000)*	0.349 (0.186)	0.650 (0.203)**	0.099 (0.243)	0.498 (0.158)**	68%
Cost_telehealth	-0.041 (0.009)**	-0.059 (0.012)**	-0.224 (0.090)*	-0.038 (0.006)**	-0.078 (0.036)*	-0.041 (0.006)	-0.050 (0.000)**	-0.034 (0.005)**	-0.041 (0.006)**	-0.040 (0.008)**	-0.040 (0.005)**	-81%
Moderately_Positive	1.713 (0.401)**	1.107 (0.337)**	9.313 (4.067)*	1.043 (0.219)**	2.516 (1.272)*	1.090 (0.244)	1.027 (0.000)**	1.066 (0.207)**	1.113 (0.250)**	1.239 (0.343)**	1.052 (0.168)**	99%
Very_Positive	1.508 (0.452)**	1.213 (0.430)**	8.256 (3.769)*	0.966 (0.251)**	3.776 (1.883)*	0.932 (0.278)	0.928 (0.000)*	1.028 (0.243)**	1.148 (0.340)**	1.315 (0.420)**	1.031 (0.206)**	82%

Attribute levels	**Gender**		**Living arrangements**		**Education level**		**Did participant use the internet for health-related issues in previous 3 months?**		**Did participant have a long-term disability?**		**TOTAL sample**	**TOTAL sample (% positive)[b]**
	Female	Male	Living alone	Living with others	Up to High School	Post-High School	Yes	No	Yes	No		
Standard Deviations												
Most_CareAspects	0.399 (0.420)	-0.074 (0.477)	-1.299 (0.966)	0.003 (0.327)	-1.672 (0.994)	0.300 (0.381)	-0.382 (0.000)	0.140 (0.325)	0.197 (0.437)	0.089 (0.926)	0.020 (0.321)	
All_CareAspects	-1.082 (0.446)*	-1.045 (0.417)*	7.859 (3.390)*	0.485 (0.367)	-1.350 (1.149)	1.009 (0.328)	-0.990 (0.000)	0.465 (0.363)	0.630 (0.497)	1.044 (0.394)**	0.827 (0.285)**	
Some_Experience	0.218 (0.456)	0.296 (0.621)	-5.389 (2.425)*	-0.289 (0.278)	-0.269 (0.711)	0.391 (0.349)	-0.084 (0.000)	-0.248 (0.364)	0.522 (0.367)	-0.232 (0.336)	0.098 (0.282)	
Lots_Experience	2.340 (0.620)**	-1.474 (0.530)**	11.810 (5.078)*	-1.402 (0.362)**	3.561 (1.787)*	1.357 (0.426)	2.435 (0.000)**	0.728 (0.475)	1.476 (0.403)**	1.632 (0.493)**	1.383 (0.270)**	
Some_Assessments	1.003 (0.458)*	-0.681 (0.471)	-4.708 (2.135)*	-0.780 (0.235)**	1.566 (0.750)*	-0.457 (0.454)	1.085 (0.000)**	0.370 (0.288)	-0.331 (0.390)	0.935 (0.397)*	0.710 (0.229)**	

Attribute levels	**Gender**		**Living arrangements**		**Education level**		**Did participant use the internet for health-related issues in previous 3 months?**		**Did participant have a long-term disability?**		**TOTAL sample**	**TOTAL sample (% positive)[b]**
	Female	Male	Living alone	Living with others	Up to High School	Post-High School	Yes	No	Yes	No		
All_Assessments	1.404 (0.513)**	-0.685 (0.408)	1.243 (1.208)	0.660 (0.306)*	-0.894 (0.802)	1.131 (0.396)	0.042 (0.000)	-0.940 (0.321)**	-0.542 (0.422)	-0.338 (0.462)	-0.649 (0.283)*	
Cost_telehealth	0.048 (0.012)**	0.050 (0.011)**	0.135 (0.055)*	0.042 (0.007)**	0.090 (0.039)*	0.037 (0.007)	0.044 (0.000)**	0.031 (0.005)**	0.035 (0.007)**	0.042 (0.009)**	0.038 (0.005)**	
LL[c]	-436.266	-373.03	-209.098	-612.774	-299.938	-518.083	-327.087	-494.839	-474.537	-348.112	-830.715	
AIC[d]	908.532	782.059	454.197	1261.548	635.876	1072.166	690.174	1025.679	985.073	732.225	1697.431	
N	89	241	123	207	171	159	138	192	198	132	330	
Obs	890	2410	1230	2070	1710	1590	1380	1920	1980	1320	3300	
LL[c] for S-L Test[e]	42.839		17.686		25.388		17.578		16.133			

[a] In the simulation-based technique, 500 Halton draws were run (both models based on total sample). Figures are coefficient (standard errors). */** Coefficient statistically significant at 5% / 1% level of significance

[b] The proportion of respondents for whom a telehealth attribute has a positive or negative effect on preference for a telehealth package; [c]LL = Log Likelihood; [d]AIC = The Akaike information criterion

[e] S&L test = Swait-Louviere Test where the sum of LL statistics of complementary subgroups was subtracted from that for the whole sample (-830.715). The $\chi 2$ statistics from the Swait-Louviere likelihood ratio tests for equality of model parameters for the four of the five pairs of subgroups (living arrangements = 17.686; education level = 25.388; prior internet usage for health –related purposes = 17.578 and long-term disability = 16.133) were lower than the $\chi 2$ critical value of 26.296 (based on 5% level of significance and 16 degrees of freedom). The LL statistic for gender (42.839) was however higher than the critical value. Consequently, the data relating to the first four subgroups were analysed as a pooled sample in all models while that relating to gender was analysed separately for males and for females. . A similar result was obtained when the Swait-Louviere Test was applied on the conditional logit model.

Table 5: Predicted probabilities for the top 10 preferred telehealth packages

Distance to nearest hospital or clinic	Aspects of care in telehealth sessions	Technology-experience levels of patients targeted by telehealth	Assessments related to telehealth sessions	Cost of telehealth to you	Clinicians' attitude to telehealth	Preference score[a] (95% CI)	Probability[b] (95% CI)	Rank
Bet_15to100km	All_CareAspects	Some_Experience	Some_Assessments	Low	Moderately_Positive	3.654 (2.108 ,5.200)	0.108 (0.062 ,0.154)	1
Bet_15to100km	All_CareAspects	Some_Experience	Some_Assessments	Low	Very_Positive	3.633 (2.011 ,5.255)	0.108 (0.060 ,0.156)	2
Bet_15to100km	All_CareAspects	Lots_Experience	Some_Assessments	Low	Moderately_Positive	3.453 (1.868 ,5.039)	0.102 (0.055 ,0.149)	3
Bet_15to100km	All_CareAspects	Lots_Experience	Some_Assessments	Low	Very_Positive	3.432 (1.771 ,5.093)	0.102 (0.052 ,0.151)	4
Bet_15to100km	All_CareAspects	Some_Experience	All_Assessments	Low	Moderately_Positive	3.395 (1.829 ,4.962)	0.101 (0.054 ,0.147)	5
Bet_15to100km	All_CareAspects	Some_Experience	All_Assessments	Low	Very_Positive	3.374 (1.732 ,5.016)	0.100 (0.051 ,0.148)	6
Bet_15to100km	Most_CareAspects	Some_Experience	Some_Assessments	Low	Moderately_Positive	3.247 (1.716 ,4.778)	0.096 (0.051 ,0.141)	7
Bet_15to100km	Most_CareAspects	Some_Experience	Some_Assessments	Low	Very_Positive	3.226 (1.619 ,4.832)	0.095 (0.048 ,0.143)	8
Bet_15to100km	All_CareAspects	Lots_Experience	All_Assessments	Low	Moderately_Positive	3.194 (1.588 ,4.800)	0.095 (0.047 ,0.142)	9
Bet_15to100km	All_CareAspects	Lots_Experience	All_Assessments	Low	Very_Positive	3.173 (1.491 ,4.855)	0.094 (0.044 ,0.144)	10

[a] Preference scores were calculated by summing up the model coefficients for every combination of attribute levels. 95% CI = 95% confidence interval

[b] The probability that each combination of attribute levels is the most preferred scenario was calculated as preference score for that particular attribute divided by the sum of all preference scores. 95% CI = 95% confidence interval

SUPPLEMENTARY MATERIAL

Supplementary Material Table 1: Responses to attitudinal questions by type of participant

Statement	Subgroup	Response				
		Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
1. A good understanding between patients and telehealth clinicians is important for achieving good patient outcomes.	Entire sample	61	33	5	-	1
	Females	68	28	4	-	-
	Males	53	38	8	-	1
	Not living alone	59	34	5	-	1
	Living alone	66	28	6	-	-
	≤ High Sch. Education	59	36	4	-	1
	> High Sch. Education	62	31	6	-	1
	Used internet-health reasons	64	33	4	-	-
	No health-related internet use	59	33	7	-	1
	Have a long-term disability	65	27	7	-	1
	Do not have a long-term disability	55	42	3	-	-
	Located in metro area	60	35	5	-	1
	Located in the country	63	30	6	-	-
2. When services are hard to access e.g. for patients in country and rural areas, telehealth appears to be a good alternative.	Entire sample	47	44	7	1	1
	Females	47	44	8	1	1
	Males	47	43	7	1	2
	Not living alone	43	46	7	1	1
	Living alone	57	36	7	-	-
	≤ High Sch. Education	51	41	7	-	1
	> High Sch. Education	44	45	7	1	1
	Used internet-health reasons	54	41	5	-	-
	No health-related internet use	42	46	9	2	2
	Have a long-term disability	49	41	7	1	2
	Do not have a long-term disability	43	47	8	2	-
	Located in metro area	44	48	7	1	1
	Located in the country	51	38	7	1	2
3. An initial face to face health consultation in a clinic needs to occur prior to telehealth sessions.	Entire sample	38	40	14	8	1
	Females	42	35	13	9	1
	Males	33	45	15	6	1
	Not living alone	37	43	14	5	1
	Living alone	38	31	16	13	1
	≤ High Sch. Education	37	42	12	6	2

Statement	Subgroup	Response				
		Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	> High Sch. Education	38	38	15	8	1
	Used internet-health reasons	33	41	17	8	1
	No health-related internet use	41	39	12	7	1
	Have a long-term disability	39	39	14	6	2
	Do not have a long-term disability	35	41	14	10	-
	Located in metro area	36	42	16	5	-
	Located in the country	40	36	11	10	2
4. The costs associated with using telehealth should not be any higher than a face-to-face consultation.	Entire sample	47	39	9	4	1
	Females	46	40	10	4	-
	Males	48	38	9	3	1
	Not living alone	47	39	10	3	1
	Living alone	48	38	9	4	-
	≤ High Sch. Education	48	40	9	2	1
	> High Sch. Education	47	39	10	4	1
	Used internet-health reasons	42	45	10	3	-
	No health-related internet use	51	35	9	4	1
	Have a long-term disability	51	35	10	4	1
	Do not have a long-term disability	42	45	9	4	1
	Located in metro area	43	41	12	4	-
	Located in the country	52	36	7	4	1
5. Telehealth monitoring by clinicians will improve patients' motivation and willingness to comply with healthcare recommendations.	Entire sample	21	49	26	2	1
	Females	23	52	22	2	1
	Males	20	46	31	2	1
	Not living alone	20	49	28	2	1
	Living alone	25	51	21	2	1
	≤ High Sch. Education	22	46	30	1	1
	> High Sch. Education	21	51	24	3	1
	Used internet-health reasons	26	52	20	1	-
	No health-related internet use	18	46	31	3	2
	Have a long-term disability	22	48	26	3	2
	Do not have a long-term disability	20	51	27	2	-
	Located in metro area	20	52	27	1	1
	Located in the country	23	46	26	4	1
6. Telehealth improves the safety and welfare of patients.	Entire sample	22	49	27	2	1
	Females	23	51	23	2	1
	Males	20	46	31	2	1

Statement	Subgroup	Response				
		Strongly Agree	Agree	Neither agree nor disagree	Disagree	Strongly disagree
	Not living alone	18	51	27	2	1
	Living alone	30	43	26	1	-
	≤ High Sch. Education	23	46	29	2	1
	> High Sch. Education	21	51	26	2	-
	Used internet-health reasons	27	49	23	1	-
	No health-related internet use	18	49	30	3	1
	Have a long-term disability	24	46	26	3	1
	Do not have a long-term disability	18	52	28	2	-
	Located in metro area	21	49	27	2	-
	Located in the country	22	48	27	2	1
7. Health examinations need to occur face to face in a clinic and not via telehealth.	Entire sample	18	23	41	17	1
	Females	19	19	45	17	1
	Males	16	27	37	18	2
	Not living alone	18	26	39	16	2
	Living alone	16	15	48	21	-
	≤ High Sch. Education	21	23	40	15	2
	> High Sch. Education	15	23	42	19	1
	Used internet-health reasons	12	17	50	20	1
	No health-related internet use	22	27	35	15	2
	Have a long-term disability	18	20	45	16	2
	Do not have a long-term disability	17	27	35	20	1
	Located in metro area	18	24	42	15	1
	Located in the country	17	22	40	20	2
8. Telehealth leads to loss of privacy and confidentiality.	Entire sample	3	10	36	40	11
	Females	4	11	34	42	9
	Males	2	9	38	38	13
	Not living alone	3	8	39	38	12
	Living alone	2	15	29	46	8
	≤ High Sch. Education	5	10	32	40	13
	> High Sch. Education	1	10	39	40	10
	Used internet-health reasons	2	6	35	46	11
	No health-related internet use	3	13	38	35	11
	Have a long-term disability	3	12	33	40	11
	Do not have a long-term disability	2	7	41	39	11
	Located in metro area	2	7	41	41	10
	Located in the country	4	14	31	38	12

Statement	Subgroup	Response				
		Strongly Agree	**Agree**	**Neither agree nor disagree**	**Disagree**	**Strongly disagree**
9. Telehealth should only be offered to people living in the country or in a rural area.	Entire sample	12	16	32	34	7
	Females	13	16	33	32	6
	Males	10	16	31	35	8
	Not living alone	12	15	34	34	6
	Living alone	11	18	28	34	9
	≤ High Sch. Education	11	18	35	31	5
	> High Sch. Education	12	15	30	35	8
	Used internet-health reasons	12	12	30	37	9
	No health-related internet use	11	19	34	31	5
	Have a long-term disability	12	13	31	37	6
	Do not have a long-term disability	11	20	33	28	8
	Located in metro area	9	18	32	36	5
	Located in the country	14	14	32	30	9

Figures above are percentages of row totals (row totals may not add up to 100 due to rounding)

Supplementary Material Table 2: Conditional Logit regression results[a]

	Main Effects Traditional model (clogit)	**Main Effects Heteroscedastic models (clogit-het)**					
Mean							
Most_CareAspects	0.262 (0.086)**	0.291 (0.098)**	0.240 (0.085)**	0.269 (0.091)**	0.250 (0.085)**	0.218 (0.076)**	0.223 (0.083)**
All_CareAspects	0.471 (0.088)**	0.527 (0.105)**	0.442 (0.089)**	0.487 (0.097)**	0.455 (0.089)**	0.406 (0.082)**	0.436 (0.096)**
Some_Experience	0.110 (0.069)	0.122 (0.093)	0.103 (0.081)	0.109 (0.087)	0.110 (0.081)	0.092 (0.072)	0.101 (0.075)
Lots_Experience	0.161 (0.090)	0.181 (0.096)	0.156 (0.082)	0.162 (0.088)	0.154 (0.082)	0.141 (0.073)	0.150 (0.079)
Bet_15to100km	0.187 (0.081)*	0.208 (0.092)*	0.185 (0.079)*	0.191 (0.085)*	0.180 (0.079)*	0.158 (0.071)*	0.174 (0.075)*
MoreThan_100km	-0.037 (0.103)	-0.021 (0.106)	-0.039 (0.091)	-0.032 (0.098)	-0.029 (0.091)	-0.028 (0.081)	-0.003 (0.086)
Some_Assessments	0.428 (0.070)**	0.457 (0.080)**	0.405 (0.070)**	0.440 (0.076)**	0.411 (0.071)**	0.370 (0.065)**	0.379 (0.074)**
All_Assessments	0.282 (0.082)**	0.294 (0.089)**	0.263 (0.077)**	0.290 (0.083)**	0.273 (0.077)**	0.247 (0.069)**	0.246 (0.075)**
Cost of telehealth	-0.019 (0.001)**	-0.021 (0.002)**	-0.018 (0.001)**	-0.019 (0.001)**	-0.018 (0.001)**	-0.016 (0.002)**	-0.017 (0.002)**
Moderately_Positive	0.594 (0.074)**	0.647 (0.100)**	0.565 (0.084)**	0.609 (0.092)**	0.559 (0.089)**	0.503 (0.082)**	0.512 (0.098)**
Very_Positive	0.510 (0.102)**	0.572 (0.111)**	0.479 (0.093)**	0.525 (0.101)**	0.475 (0.097)**	0.422 (0.088)**	0.441 (0.104)**
	HETEROSCEDASTICITY (variables used to model error variance)						

	Main Effects Traditional model (clogit)	**Main Effects Heteroscedastic models (clogit-het)**					
Gender		-0.193 (0.110)					-0.194 (0.112)
Living arrangements			0.185 (0.117)				0.174 (0.123)
Educational level				-0.067 (0.112)			-0.064 (0.114)
Used the internet for health-related issues in 3 months prior to study					0.110 (0.109)		0.132 (0.112)
Have long-term disability						0.276 (0.118)	0.225 (0.116)
LL[b]	887.315	-885.950	-886.156	-887.134	-886.840	-884.390	-881.768
AIC[c]	-1750.630	1795.900	1796.312	1798.268	1797.671	1792.779	1795.535
N	330	330	330	330	330	330	330
Obs	3300	3300	3300	3300	3300	3300	3300

[a] In the simulation-based technique, 500 Halton draws were run (both models based on total sample).

Figures are coefficient (standard errors)

*/** Coefficient statistically significant at 5% / 1% level of significance

[b]LL = Log Likelihood; [c]AIC = The Akaike information criterion

Supplementary Material Table 3: Mixed Logit regression estimates (with interactions)[a]

Attribute levels	**Gender**		**Living arrangements**		**Education level**		**Did participant use the internet for health-related issues in previous 3 months?**		**Did participant have a long-term disability?**		**TOTAL sample**
	Female	Male	Living alone	Living with others	Up to High School	Post-High School	Yes	No	Yes	No	
Bet_15to100km	0.716 (0.318)*	0.805 (0.320)*	16.178 (7.534)*	0.597 (0.191)**	0.448 (0.474)	0.698 (0.233)	0.821 (0.000)*	0.530 (0.191)**	0.821 (0.210)*	0.501 (0.210)*	0.613 (0.154)**
MoreThan_100km	-0.141 (0.345)	0.387 (0.330)	14.731 (6.314)*	0.201 (0.188)	0.583 (0.300)	0.397 (0.242)	0.375 (0.000)	-0.026 (0.207)	0.375 (0.236)	0.157 (0.236)	0.124 (0.161)
Most_CareAspects	1.039 (0.557)	0.770 (0.500)	-5.833 (2.937)*	0.467 (0.264)	0.157 (0.398)	0.667 (0.354)	0.681 (0.000)	0.526 (0.293)	0.681 (0.332)	0.549 (0.332)	0.506 (0.227)*
All_CareAspects	1.463 (0.498)**	1.391 (0.589)*	2.292 (2.026)	0.938 (0.289)**	-0.152 (0.270)	1.758 (0.472)	1.719 (0.000)**	0.778 (0.299)**	1.719 (0.354)**	1.257 (0.354)**	0.988 (0.239)**
Some_Experience	0.493 (0.275)	0.699 (0.291)*	22.843 (9.418)*	0.427 (0.174)*	1.038 (0.471)*	0.298 (0.200)	0.728 (0.000)*	0.201 (0.176)	0.728 (0.206)	0.399 (0.206)	0.380 (0.144)**

Attribute levels	**Gender**		**Living arrangements**		**Education level**		**Did participant use the internet for health-related issues in previous 3 months?**		**Did participant have a long-term disability?**		**TOTAL sample**
	Female	Male	Living alone	Living with others	Up to High School	Post-High School	Yes	No	Yes	No	
Lots_Experience	-0.187 (0.420)	0.485 (0.339)	13.502 (5.455)*	0.162 (0.187)	0.806 (0.267)**	0.190 (0.242)	0.193 (0.000)	0.145 (0.198)	0.193 (0.222)	0.266 (0.222)	0.179 (0.163)
Some_Assessments	1.443 (0.421)**	0.398 (0.362)	3.533 (1.723)*	0.867 (0.228)**	0.601 (0.277)*	0.831 (0.280)	1.002 (0.000)**	0.613 (0.240)*	1.002 (0.260)**	0.834 (0.260)**	0.758 (0.194)**
All_Assessments	1.221 (0.554)*	0.606 (0.426)	3.939 (2.083)	0.709 (0.247)**	0.218 (0.204)	0.752 (0.371)	1.023 (0.000)*	0.613 (0.333)	1.023 (0.276)*	0.669 (0.276)*	0.718 (0.221)**
Cost of telehealth	-0.036 (0.012)**	-0.074 (0.020)**	-0.607 (0.233)**	-0.037 (0.007)**	-0.035 (0.009)**	-0.046 (0.009)	-0.054 (0.000)**	-0.035 (0.007)**	-0.054 (0.008)**	-0.042 (0.008)**	-0.039 (0.006)**
Moderately_Positive	1.838 (0.482)**	1.219 (0.414)**	10.557 (4.291)*	1.031 (0.220)**	0.419 (0.312)	1.168 (0.266)	1.077 (0.000)**	1.139 (0.210)**	1.077 (0.264)**	1.119 (0.264)**	1.058 (0.170)**
Very_Positive	1.630	1.411	3.111	0.964	0.317	0.958	0.897	1.378	0.897	1.164	1.025

Attribute levels	**Gender**		**Living arrangements**		**Education level**		**Did participant use the internet for health-related issues in previous 3 months?**		**Did participant have a long-term disability?**		**TOTAL sample**
	Female	Male	Living alone	Living with others	Up to High School	Post-High School	Yes	No	Yes	No	
	(0.530)**	(0.550)	(2.205)	(0.254)**	(0.207)	(0.301)	(0.000)*	(0.299)**	(0.365)**	(0.365)**	(0.208)**
Interactions											
Metro_Most_CareAspects	-0.126 (0.647)	-0.153 (0.559)	-10.564 (5.478)	0.068 (0.330)	-0.408 (0.602)	-0.470 (0.414)	0.079 (0.000)	-0.020 (0.349)	0.079 (0.395)	-0.135 (0.395)	-0.044 (0.272)
Metro_All_CareAspects	-0.635 (0.607)	0.086 (0.590)	-1.424 (5.575)	0.084 (0.311)	-1.062 (0.999)	-0.778 (0.451)	-0.342 (0.000)	-0.222 (0.360)	-0.342 (0.399)	-0.492 (0.399)	-0.171 (0.285)
Metro_Some_Assessments	-0.285 (0.443)	0.345 (0.478)	3.350 (2.051)	-0.234 (0.267)	-0.615 (0.342)	0.200 (0.313)	0.122 (0.000)	-0.018 (0.291)	0.122 (0.309)	-0.043 (0.309)	0.001 (0.227)
Metro_All_Assessments	-0.746 (0.560)	-0.398 (0.509)	1.836 (2.053)	-0.342 (0.322)	0.024 (0.278)	-0.365 (0.469)	-0.716 (0.000)	-0.373 (0.399)	-0.716 (0.372)	-0.067 (0.372)	-0.410 (0.278)

Attribute levels	**Gender**		**Living arrangements**		**Education level**		**Did participant use the internet for health-related issues in previous 3 months?**		**Did participant have a long-term disability?**		**TOTAL sample**
	Female	Male	Living alone	Living with others	Up to High School	Post-High School	Yes	No	Yes	No	
Metro_ Cost of telehealth	-0.013 (0.010)	0.014 (0.011)	-0.095 (0.049)	0.000 (0.007)	-0.013 (0.010)	0.003 (0.008)	0.009 (0.000)	-0.007 (0.007)	0.009 (0.007)	0.000 (0.007)	-0.002 (0.005)
Standard Deviations											
Most_CareAspects	0.319 (0.568)	-0.129 (0.481)	10.557 (4.291)*	0.013 (0.332)	0.323 (0.218)	0.368 (0.376)	-0.057 (0.000)	0.212 (0.306)	-0.057 (0.449)	0.225 (0.449)	0.072 (0.323)
All_CareAspects	-1.182 (0.579)*	-1.125 (0.448)*	3.111 (2.205)	0.471 (0.355)	0.524 (0.333)	1.107 (0.333)	-1.197 (0.000)*	0.606 (0.360)	-1.197 (0.484)	0.634 (0.484)	0.837 (0.284)**
Some_Experience	0.227 (0.805)	-0.056 (0.541)	-18.629 (7.135)**	-0.287 (0.286)	1.721 (0.434)**	0.516 (0.357)	0.120 (0.000)	0.011 (0.366)	0.120 (0.377)	0.537 (0.377)	0.111 (0.288)
Lots_Experience	2.409	-1.709	5.628	-1.368	0.031	1.538	2.434	1.192	2.434	1.510	1.398

Attribute levels	**Gender**		**Living arrangements**		**Education level**		**Did participant use the internet for health-related issues in previous 3 months?**		**Did participant have a long-term disability?**		**TOTAL sample**
	Female	Male	Living alone	Living with others	Up to High School	Post-High School	Yes	No	Yes	No	
	(0.598)**	(0.660)	(2.050)**	(0.361)**	(0.316)	(0.448)	(0.000)**	(0.349)**	(0.431)**	(0.431)**	(0.272)**
Some_Assessments	1.011 (0.688)	-0.766 (0.478)	12.655 (4.976)*	-0.772 (0.233)**	0.423 (0.248)	-0.342 (0.506)	1.104 (0.000)**	-0.479 (0.320)	1.104 (0.367)	-0.298 (0.367)	0.682 (0.232)**
All_Assessments	1.552 (0.677)*	-0.848 (0.445)	-13.164 (5.087)	0.613 (0.321)	0.177 (0.317)	1.354 (0.435)	0.150 (0.000)	0.969 (0.309)**	0.150 (0.441)	-0.540 (0.441)	-0.621 (0.282)*
Cost of telehealth	0.049 (0.012)**	0.057 (0.018)**	0.672 (0.259)**	0.041 (0.007)**	0.043 (0.009)**	0.041 (0.008)	0.042 (0.000)**	0.036 (0.006)**	0.042 (0.008)**	0.036 (0.008)**	0.038 (0.005)**
LL[b]	-429.833	-374.408	-210.392	-603.349	-296.202	-505.399	-325.409	-485.877	-476.052	-347.128	-819.124
AIC[c]	909.665	798.816	470.783	1256.697	642.405	1060.80	700.819	1021.755	1002.105	744.256	1688.248
N	89	241	123	207	171	159	138	192	198	132	330

Attribute levels	**Gender**		**Living arrangements**		**Education level**		**Did participant use the internet for health-related issues in previous 3 months?**		**Did participant have a long-term disability?**		**TOTAL sample**
	Female	Male	Living alone	Living with others	Up to High School	Post-High School	Yes	No	Yes	No	
Obs	890	2410	1230	2070	1710	1590	1380	1920	1980	1320	3300

[a] In the simulation-based technique, 500 Halton draws were run (both models based on total sample). Figures are coefficient (standard errors). */** Coefficient statistically significant at 5% / 1% level of significance

[b] LL = Log Likelihood; [c]AIC = The Akaike information criterion